Shri Vishwanath P. G. College Kalan, Sultanpur

(Affiliated)

DR. RAM MANOHAR LOHIA AVADH UNIVERSITY, AYODHYA

Structure of Syllabus for the Program: M.Sc.

Subject: PHYSICS

Course Code		Course Title	Credits	T/P	Evaluation	
					CIE	ETE
A	B	C	D	E	F	G
(First Year) Semester-I						
B010701T	CORE	Mathematical Methods for Physics	5	T	25	**75**
B010702T	CORE	Classical Mechanics	5	T	25	**75**
B010703T	CORE	Quantum Mechanics	5	T	25	**75**
B010705T	FIRSTELECTIVE (Subject Elective)	Lasers, Optical Fibers and Sensors	5	T	25	**75**
B010707P	SECONDELECTIVE (Subject Elective)	ElectronicsLab-1	5	P	25	**75**
(First Year) Semester-II						
B010801T	CORE	Advanced Quantum Mechanics	5	T	25	**75**
B010802T	CORE	Electrodynamics	5	T	25	**75**
B010803T	CORE	Electronics	5	T	25	**75**
B010804T	THIRDELECTIVE (Subject Elective)	Physics in Daily Life	5	T	25	**75**
B010807P	FOURTHELECTIVE (Subject Elective)	ElectronicsLab-2	5	P	25	**75**
(Second Year) Semester-III						
B010901T	CORE	Nuclear Physics	5	T	25	**75**
B010902T	CORE	Atomic & Molecular Spectroscopy	5	T	25	**75**
B010903T	CORE	Digital Electronics & Microprocessor	5	T	25	**75**
B010904T	FIFTHELECTIVE (Subject Elective)	Statistical Physics	5	T	25	**75**
B010907P	SIXTHELECTIVE (Subject Elective)	ElectronicsLab-3	5	P	25	**75**
(Second Year) Semester-IV						
B011001T	CORE	Condensed Matter Physics	5	T	25	**75**
B011002T	CORE	Communication and Microwave Electronics	5	T	25	**75**
B011004P	SEVENTH ELECTIVE	ElectronicsLab-4	5	P	50	**50**
B011005P	RESEARCHPROJECT/ DISSERTATION	Major Research Project/Dissertation	10	P	50	**50**

Semester I

Theoretical Paper-I

B010701T: Mathematical Methods for Physics

Unit I

Errors and Measurements

General formula for Errors-Errors and its Types-Graphical Method - Empirical formula - Principle of Least Squares- Fitting a straight line-Fitting a Parabola-Fitting an Exponential Curve-Fitting the curve (y=axb)

Unit II

Special Functions:

Second order ordinary differential equations, Legendre's equation, Legendre polynomials and their properties, Bessel's equation, Bessel function and their properties, Laguerre's equation, its solutions and properties, Hermite equation, Hermite Polynomials and their properties. Green's function.

Unit-III

Complex Variables:

Functions of a complex variable – Single and multi valued functions - Analytic functions - Cauchy Riemann conditions – Singular points - Cauchy's integral theorem and formula - Taylor and Laurent expansions – Zeros and poles - Residue theorem - applications to evaluation of definite integrals.

Unit-IV

Laplace and Fourier Transform:

Laplace transforms: solution of linear differential equations with constant Coefficients – Fourier integral. Fourier transforms: Fourier sine and cosine transforms – Convolution theorems – Applications.

References :

1. Mathematical method for Physicists, Arfken& Weber, Elsevier Academic Press
2. Mathematical Method for Physics and Engineers, K.F.Reily, M.P.Hobson and S.J.Bence, Cambridge University Press
3. Advanced Engineering Mathematics, E. Kreyszig, John Wiley & Sons
4. Special Functions, E.D. Rainville, Chelsea Publication Co.
5. Special Functions for Scientists and Engineers, W.W. Bell, Dover Publications

Theoretical Paper-II

B010702T: Classical Mechanics

Unit I

Lagrangian Formulations:

System of particles and equation of motion of a system of particles, conservation of linear momentum, energy and angular momentum. Constraints, generalized co- ordinates, virtual displacement, D'Alembert's principle, Lagrange's equations of motion and its application, Single free particle, a bead sliding on a uniformly rotating wire in a force-free space, Simple Pendulum, Compound Pendulum.

Unit II

Hamilton Formulations:

Generalized momenta, canonical variables, Legendre transformations and the Hamilton's equation of motion, Examples of (a) The Hamiltonian of a particle in a central force field, (b) the simple harmonic oscillator. Cyclic co-ordinates and conservation theorems, derivation of Hamilton's equations from variational principle.

Unit III

Central Force Problem:

Reduction of two body problem into one-body problem, reduced mass of the system, conservation theorems (First integrals of the motion), equations of motion for the orbit, classification of orbits, conditions for closed orbits, The Kepler problem (inverse-square law of force).

Unit IV

Small Oscillations:

Types of equilibrium, Quadratic forms for kinetic and potential energies of a system in equilibrium, Lagrange's equations of motion, Normal modes and normal frequencies, examples of (a)longitudinal vibrations of two coupled harmonic oscillators (b) linear, symmetric, triatomic molecule, (c) oscillations of two linearly coupled plane pendulum.

Reference:

1. Classical Mechanics, H. Goldstein, Narosa Publishing House
2. Classical Mechanics, N.C. Rana and P.S. Joag, Tata McGraw Hill
3. Introduction to Dynamics, I.C. Percival and D. Richards, Cambridge University Press
4. Classical Mechanics, Gupta and Kumar, PragatiPrakashan, Meerut.

Theoretical Paper-III

B010703T: Quantum Mechanics

UNIT-I

Basic formalism

Wave functions for a free particle - Interpretation and conditions on the wave function - Postulates of quantum Mechanics and the Schrödinger equation - Ehrenfest's theorem - Expectation Value - Stationary States - Hermitian Operators for dynamical variables - Eigen values and Eigen functions - Uncertainty Principle.

UNIT-II

One Dimensional and Three Dimensional Problems

One Dimensional: Particle in a box – simple harmonic oscillator - Square well potential – Barrier penetration – Three Dimensional: Orbital angular momentum and spherical harmonics - Central forces and reduction of two body problem - Particle in a Spherical well - Hydrogen atom.

UNIT-III

General formalism

Hilbert's space - Dirac notation - Representation theory - Co-ordinate and momentum representations - Time evolution - Schrödinger, Heisenberg and Interaction pictures - Symmetries and conservation laws - Unitary transformations associated with translations and rotations.

UNIT-IV

Approximation methods

Time-independent perturbation theory for non- degenerate and degenerate levels - Application to ground state of an harmonic oscillator and Stark effect in Hydrogen .

References:

1. Introduction to Quantum Mechanics by David J. Griffiths, Pearson (2005).
2. Quantum Mechanics by G. Aruldhas, PHI, India.
3. Quantum Mechanics: Concepts and Applications by N. Zettili, Wiley
4. Quantum Mechanics by L.I. Schiff, Tata Mcgraw Hill Education Private Limited Tata Mcgraw Hill Education Private Limited (2010).
5. Modern Quantum Mechanics by J. J Sakurai, Pearson (1994).
6. Quantum Mechanics: Theory And Applications by A. Ghatak, Macmillan India Limited (2004).
7. Quantum Mechanics: An Introduction by Walter Greiner, Springer (India) Pvt. Ltd. (2008)
8. Quantum Physics: Of Atoms Molecules Solids Nuclei AndPracticles by Robert Resnick and Robert Eisberg, Wiley India Pvt Ltd (2006).

Theoretical Paper-IV
(Optional)
B010705T : Lasers, Optical Fibers and Sensors

UNIT- I

MASERS, Concept of Population Inversion, Laser Pumping, Resonators, Ruby laser, HeliumNeon laser, Semiconductor lasers, Liquid laser, Dye laser and Chemical laser, Properties of lasers, Lasers in Chemistry, Communication by Laser, Laser in Atmospheric Optics, Laser in Astronomy, Laser in Biology, Laser in Medicine, Laser in Industry.

UNIT- II

Demands of Information Age, The promise of Optical information processing, Evolution of Fiber Optics, Optical fiber Communication System, Block diagram of Optical fiber Communication System, Light propagation through medium, Total internal reflection, Numerical Aperture, Acceptance Angle.

UNIT- III

The optical fiber, Structure and types of fiber, Single mode fiber, Multimode Fiber, Step-index fiber, Graded-index fiber, Attenuation loss, Fiber materials, Fabrication of Optical fibers, Mechanical Misalignment, Fiber joints and Couples, Fiber Splicing, Demonstration of fiber optic communication.

UNIT- IV

Optical Sensors, Advantages of optical Sensors, Properties of Sensors, Sensors types, Biomedical Sensors, Chemical Sensors, Electrical and Magnetic Sensors, Rotation Sensors, Fiber-Optic Gyroscope, Sensors for structural health monitoring, Miscellaneous Sensors.

Reference Books:

1. Optical Fiber Communication Principle and Practice: John M Senior, Pearson Education.
2. Optical Communication System: John Gower, Prentice Hall of India
3. Fiber Optics Communication: Palais, University Press
4. Introduction to Optical Fibers and its Applications: Rajesh Shukla LAP LAMBERT Academic Publishing
5. Nonlinear Fiber Optics: G.P. Agarwal, Academic Press, San Diego California.
6. Laser: Eberly
7. Principles of Laser: OrazioSvelto, Springer
8. Introduction to Optics: Anchal Srivastava etc, New Age International Publishers, New Delhi
9. Laser, theory and Applications: K. Thyagarajan

Practical

B010707P: Electronics Lab-I

A. List of Experiments:

1. Study of Half / Full Bridge rectifier circuits with filters.
2. Setting up a Power Supply using a Zener Diode as Voltage Regulator.
3. Study of Bipolar Junction Transistor Static Characteristics.
4. Study of CE, CB and CC configuration of BJT circuit.
5. Study of Field Effect Transistor Characteristics.

B. Project Presentation / Seminar on an assigned topic.

**Marks distribution :*

ETE : One practical – 50

CTE : Practical record (20) + Seminar (30) = 50

Semester II

Theoretical Paper-I

B010801T: Advanced Quantum Mechanics

Unit-I

Perturbation Theory : Perturbed oscillator, First order Stark effect, Zeeman effect, Variation method: Basic principles, Applications to: One dimensional harmonic oscillator, Ground state energy of hydrogen atom, Ground state of helium atom, Time dependent perturbation theory, Emission and absorption of radiation, Spontaneous emission.

Unit-II

Relativistic Quantum Mechanism:

Free particle Klein-Gordan equation, Charge and current densities, Minimal electromagnetic coupling, Dirac's relativistic equation, Covariant form of the Dirac's equation, Adjoint Dirac equation, Continuity equation.

Unit-III

Dirac Equation :

Free particle solutions, Dirac and Feynman interpretation of negative energy states, Dirac equation in electromagnetic field and its non-relativistic reduction, Dirac's equation in a central field: spin angular momentum, spin-orbit energy, the hydrogen atom.

Unit-IV

Quantization of Fields:

Single-particle and Many-particle Hilbert space, Fock Space, Introduction to second quantization, Occupation number representation, Creation and annihilation operators, Bosons. Representation of operators: Change of basis and the field operator, Representation of one-body and two-body operators. Applications of Second Quantisation.

References:

1. Quantum Mechanics by L.I. Schiff, Tata Mcgraw Hill Education Private Limited Tata Mcgraw Hill Education Private Limited (2010).
2. Introduction To Quantum Mechanics by David J. Griffiths, Pearson (2005).
3. Advanced Quantum Mechanics by J. J Sakurai, Pearson (2005).
4. Quantum Mechanics: Theory And Applications by A. Ghatak, Macmillan India Limited (2004).
5. Relativistic Quantum Fields by James D. Bjorken, Sidney D. Drell, Dover publications (2012)
6. A First Book Of Quantum Field Theory by A Lahiri, Narosa Book Distributors Pvt Ltd (2005).
7. Quantum Field Theory by F. Mandl and G. Shaw, John Wiley & Sons (20100525). 8. Principles of Quantum Mechanics by R. Shankar, Springer (2006).

Theoretical Paper-II

B010802T: Electrodynamics

UNIT I

Electrostatics Differential equation for electric field, Poisson and Laplace equations, Boundary value problems, Solutions of Laplace equation in cylindrical and spherical coordinates by orthogonal functions, dielectrics, polarization of a medium, electrostatic energy.

UNIT II

Maxwell's Equations Displacement current, vector and scalar potentials, gauge symmetry, Coulomb and Lorentz gauges, electromagnetic energy and momentum, conservation laws, inhomogeneous wave equation and Green's function solution. Electromagnetic Waves Plane waves in a dielectric medium, reflection and refraction at dielectric interfaces, frequency dispersion in dielectrics and metals, dielectric constant and anomalous dispersion, wave propagation in one dimension, group velocity, metallic wave guides, boundary conditions at metallic surfaces, propagation modes in wave guides, resonant modes in cavities.

UNIT III

Radiation Field of a localized oscillating source, fields and radiation in dipole and quadrupole approximations, antenna, radiation by moving charges, Lienard-Wiechert potentials, total power radiated by an accelerated charge, Lorentz formula.

UNIT IV

Concepts of Plasma Physics Formation of plasma, Debye theory of screening, plasma oscillations, motion of charges in electromagnetic fields, magneto-plasma, plasma confinement, hydromagnetic waves.

References:

1. J.D. Jackson, Classical Electrodynamics.
2. D.J. Griffiths, Introduction to Electrodynamics.
3. J.R. Reitz, F.J. Milford and R.W. Christy, Foundations of Electromagnetic Theory.
4. W.K.H. Panofsky and M. Phillips, Classical Electricity and Magnetism.
5. F.F. Chen, Introduction to Plasma Physics and Controlled Fusion.

Theoretical Paper-III

B010803T: Electronics

Unit-I

Operational Amplifier :

Introduction to OP-Amp, Basic parameters, Applicability of OP-Amp in analog computation, OP-Amp as voltage follower, Adder, Substractor, Integrator, Differentiator, Log amplifier, Anti-log Amplifier, Analog multiplier & divider circuit. OP-Amp as Low pass filter, High Pass, Band pass filter and Band elimination filter.

Unit-II

Transistor Oscillators :

Oscillator as positive feedback amplifier, Condition of sustained oscillations, Phase shift and Weinbridge Oscillator, Hartley &Colpits circuit, Negative resistance oscillator, Frequency stability & distortion in oscillators, Miller circuit.

Unit-III

Non Sinusoidal Generators :

Multi vibrators, Bistable, Mono stable and astablemultivibrator, Saw tooth wave generators, Pulse generator, Clipping and Clamping circuits.

Unit-IV

Power Electronics

Power Devices:

SCR- basic structure, I-V characteristics and two transistor model, DIAC and TRIAC, Basic structure, Operation timer and equivalent I-V characteristics, TRIAC as high power switch, DIAC as triggering device of TRIAC, UJT in over voltage protection, Saw toothwave generation using UJT.

Regulator Circuits:
Load and Line regulation, Stablization ratio, Internal impedance andtemperature coefficient of voltage regulation, Linear voltage regulation circuit.

Text and Reference Books:

1. Principle of electronics – V K Mehta
2. Switch model power conversion basic theory & design – Kitscem (MorcelDecnar, New York)
3. Power Electronics- P C Sen (Tata McGraw Hill)
4. Electronic Devices & Circuits- Millman&Halkias
5. Functional Electronics- Raja Raman

Theoretical Paper-IV
(Optional)

B010804T: Physics in Daily Life

Unit I

Units, Dimensions and Errors:
Fundamental and derived quantities. Units and dimensions, dimensional analysis, order of magnitude, significant figures, errors.

Light:
Reflection, refraction, diffraction, interference, scattering (elementary ideas only) – examples from daily life – apparent depth, blue color of sky, twinkling of stars.

Total internal reflection, mirage, sparkling of diamond, primary and secondary rainbow – optical fibres. Concave and convex mirrors, lenses – focal length, power of a lens, refractive index, prism, dispersion. Human eye, defects of the eye – myopia, hypermetropia, presbyopia and astigmatism and their correction by lens.

Unit II

Motion :
Velocity, acceleration, momentum, Idea of inertia, force - laws of motion. Newton's law of gravitation, acceleration due to gravity, mass and weight, apparent weight, weight lessness. Rotational motion, Moment of inertia, torque, centripetal and centrifugal acceleration examples- banking of curves, centrifugal pump etc.

Unit III

Electricity:
Voltage and current, ohms law. Electric energy, electric power, calculation of energy requirement of electric appliances – transformer, generator, hydroelectric power generation – wind power – solar power – nuclear power

Matter and energy:
Different phases of matter, fluids-surface tension, viscosity- capillary rise, Bernoulli's theorem and applications. Heat energy, temperature, different temperature scales – degree Celsius, Fahrenheit and Kelvin. Waves – transverse and longitudinal waves, sound waves, Doppler Effect. Lasers, fluorescence, phosphorescence, electromagnetic waves – applications – microwave oven, radar, super conductivity.

Unit IV

Universe: Planets, – solar system, moon- faces of moon, lunar and solar eclipses, constellations, Different types of stars, Galaxies, black hole. Satellites, Artificial satellites, Global positioning system. Geo stationary satellite.

Reference Texts

- Fundamentals of Physics with Applications by Arthur Beiser
- Conceptual Physics by Paul G Hewitt

Practical

B010807P : Electronics Lab-II

A. List of Experiments

1. Study of Op-amp - Basic operational circuits.
2. Astable and mono stable multivibrators using IC 555.
3. Characteristics of SCR.
4. Characteristics of LDR.
5. Up/down counter using mod10

B. Industrial Training / Field visit.

**Marks distribution :*

ETE : One practical – 50

CTE : Practical record (20) + Field (30) = 50

SEMSETER - III

Theoretical Paper-I

B010901T: Nuclear Physics

Unit-I

Binding Energy:

Basic properties of nuclei, nuclear stability, nuclear size by electron scattering.

Nuclear Forces:

Ground state of deuteron, n-p scattering, analysis by method of partial wave, effective range theory, p-p scattering , charge independence and charge symmetry. Non central forces, exchange forces, isospin and charge independence, Pion theory of nucleon forces (elementary treatment).

Unit-II

Nuclear Models :

Liquid drop model, Single particle model of nucleus, shell model, Magic numbers, magnetic moments and Schmidt lines, Collective model (qualitative discussion).

Nuclear reactions:

Concept of scattering and absorption cross sections, Partial wave analysis, Optical theorem, Compound nucleus, Breit- Wigner formula, Direct reaction , kinematics of nuclear reactions.

Unit-III

Nuclear Decay :

α-decay and Geiger-Muller law, Gammow's theory, β-decay – parity violation, selection rules, Fermi theory, Fermy-Curie plots, Comparative half life, -decay-multipole radiation, selection rules, photo disintegration of deuteron.

Unit-IV

Particle Physics:

Concept of elementary particles, Basic idea of fundamental interactions in nature, classification , conservative laws , Invariance associated production, strange particles, Quark model, Gell-Mann-Nishijima formula, symmetry transformation.

Reference Books:

1. Atomic & Nuclear Physics- S N Ghosal
2. Nuclear Physics- D C Tayal
3. Nuclear Physics- Roy and Nigam
4. Nuclear Physics- Berkhum
5. Nuclear and Particle Physics- E B Paul

Theoretical Paper-II

B010902T: Atomic & Molecular Spectroscopy

UNIT-I

Quantum mechanical treatment of one electron atom, fine structure of hydrogen atom. Spectra of alkali elements, singlet and triplet states of He.

UNIT-II

Spin-orbit interaction, L-S and J-J coupling, Lande g-factor for L-S coupling, Lande interval rules, selection rules, Intensity relations, Zeeman (Normal and anomalous), Paschen back and stark effects, hyperfine structure and isotopic shift, Lamb shift.

UNIT-III

Spectra of Diatomic Molecules Rotational Spectra (rigid rotator and non-rigid rotator model) Vibrational Spectra (harmonic and enharmonic model) Molecular Symmetric Top, Vibrating rotator Isotopic shift.

UNIT-IV

Raman Spectra (Quantum mechanical and classical approach) Electronic Spectra-vibrational structure of band system, fine structure of the band systems. Intensity distribution in band systems: Frank Condon principle.

Books for Study:

1. H.E. White, Introduction to Atomic spectra
2. C.N. Banwell, Fundamental of Molecular spectroscopy, TMH.
3. G. Herzberg, Atomic spectra & Structure
4. Bransden and Joachain, Physics of Atoms and Molecule
5. Rajkumar, Atomic & Molecular Spectroscopy
6. Gupta, Kumar & Sharma, Elements of Spectroscopy

Books for Reference:

1. J. M. Brown, Molecular spectroscopy
2. G. M. Barrow, Introduction to Molecular spectroscopy
3. P.F. Bemath, Spectra of Atoms and Molecule
4. B. P. Stranghan and S. Walker, Spectroscopy, Vol I, II and III.
5. G. K. Woodgate, Elementary atomic structure, Claredon Press.

Theoretical Paper-III

B010903T : Digital Electronics and Microprocessor

Unit-I

Number systems, Code (Grey code, ASCII code & BCD code), Basic logic gates, DTL, RTL TTL & ECL logic circuits, Analysis and synthesis of combinational logic circuits, Karnaugh map, Pairs, Quad & Octets.

Unit-II

Arithmetic logic circuits, Controlled inverter and adder substractor circuits, Data processing circuits, Multiplexers, Demultiplexers, Encoder & Decoder, (1 of 16 decoder, BCD decoder & LED decoder)

Unit-III

Introduction to FF, R-S, D, T, J-K and J-K master slave FF, Synchronous and asynchronous counters, Mode counters, Ring counter, Serial and parallel shift registers.

Introduction to semiconductor memories, RAM, ROM, EPROM and their addressing techniques, A/D and D/A converter, 555 timer and its application as mono stable , astable and multivibrator.

Unit-IV

Microprocessor Architecture & Programming:

Introduction to microprocessor, Architecture of 8085 system components, Control signal of 8085, System timing diagram, Memory R/W cycle, instruction set of 8085, Addressing modes, Elementary programming , concept of 8085 M.P.

Data Transfer Scheme & Memory Interfacing:

Data transfer scheme in microprocessor, Memory mapped I/O and I/O mapped, I/O scheme synchronous, Asynchronous & interrupts driven schemes, Hardware and software interrupts of 8085, Concept of memory & I/O interfacing of DMA, Controller.

Text and References Books

1. Digital principle and application- Malvino and Leach
2. Modern digital electronics- R P Jain
3. Microprocessor- Gaonkar
4. Microprocessor and interfacing- Douglas Hall

Theoretical Paper-IV (Optional)

B010904T: Statistical Physics

Unit-I

Introduction to statistical physics:

Phase space and phase space trajectory, concept of a statistical ensemble, distribution function, mean value of a physical quantity, statistical equilibrium, statistical independence and quasi-closed systems. Liouville's theorem (no derivation) and its significance, thermodynamic potential: Helmholtz and Gibb's potentials, first and second order phase transitions.

Unit-II

Ensemble Theory:

Concept of ensembles: microcanonical, canonical and grand canonical ensembles. Microcanonical distribution in classical statistics. Gibb's canonical distribution. Partition function, grand canonical distribution, free energy and equation of state of an ideal gas, chemical potential of a monoatomic ideal gas. Statistical distribution in quantum statistics.

Unit-III

Quantum statistics:

Fermi-Dirac and Bose-Einstein distribution, F-D and B.E gases of elementary particles. The electron gas in metals, Degenerate electron gas-equation of state, degeneracy temperature, specific heat. Degenerate Bose Gas, Specific heat and pressure, B-E condensation, Ising model, Diffusion equation.

Unit-IV

Fluctuations:

Fluctuations in ensemble, correlation of space-time dependent fluctuations, fluctuations and transport phenomenon, Brownian motion, Langevin theory, fluctuation dissipation theorem, Fokker-Plank equation.

Reference Books:

1. F. Reif, Fundamentals of Statistical and Thermal Physics.
2. K. Huang, Statistical Mechanics.
3. R.K. Pathria, Statistical Mechanics.
4. D.A. McQuarrie, Statistical Mechanics.
   S.K. Ma, Statistical Mechanics.

Practical

B010907P : Electronics Lab-III

A. List of Experiments :

1. Study and Verification of Basic and Universal gates.
2. Design & Implementation of half and full adder using XOR & NAND gates
3. Realization of SR, JK, D and T flip-flops.
4. Design and implementation of comparator using logic gates and IC 7485.
5. Microprocessor kit:

   (a) hardware familiarization

   (b) Programming for (i) addition and subtraction of numbers using direct and indirect addressing modes (ii) Handling of 16 bit numbers (iii) use of CALL and RETURN instructions and block data handling.

B. Project Presentation / Seminar on an assigned topic.

**Marks distribution :*

ETE : One practical – 50

CTE : Practical record (20) + Seminar (30) = 50

Semester IV

Theoretical Paper-I

B011001T: Condensed Matter Physics

Unit-I

Lattice Dynamics:

Central and non central forces, Generailized force constants, Harmonic approximation,, three dimensional lattice, Dielectric constants, source of polarizability and Clausius-Mossoti relation, introduction to liquid crystals-sematic and nematic, principle uses of liquid crystals (qualitative).

Unit-II

Electron Band Theory:

Bloch theorem, one electron band theories, plane wave like localized wave functions, nearly free electron approximation, linear combination of atomic orbitals (LCAO) method, tight binding approximation.

Unit-III

Superconductivity:

Persistent current, Meissner effect, Isotopic effect, Type-I and type-II superconductors, electronic specific heat, London's equation, simple idea about screened Coulombian interaction.

Cooper pairs, elementary idea about BCS theory , Ground state energy, Superconducting tunneling, Josephson effect.

Unit-IV

Magnetism:

Paramagnetism, molecular field theory of ferromagnetism, exchange interaction between spins, ferromagnetic and anti-ferromagnetic order, neutron diffraction method to obtain magnetic order in ferromagnetic and anti ferromagnetic cases of ferroelectricity.

Lattice defect:

Point defect, Frenkel and Schottky defect, color centres, number of defects (vacancies) in equilibrium, dislocation edge and screw, Burger vector, role of dislocation in material strength and crystal growth.

Reference Books:

1. Solid State Physics- C. Kittle
2. Quantum theory of Solids- C Kittle
3. Theoretical Solid State Physics- Wuang
4. Solid State Physics- S O Pillai
5. Mossbauer effect and its application – V G Bhinde
6. Semiconductor Physics- S M Sze

Theoretical Paper-II

B011002T: Communication and Microwave Electronics

Unit-I

Analog and Digital Communication : Different type of modulation, Amplitude modulation, Depth of modulation, Frequency spectrum, Square law modulation, Balanced modulator, DSBSC modulation, SSB modulation, Frequency modulation, Reactance tube modulation, Detection of AM and FM waves, linear diode detector, Foster- Shelley discriminator and ratio detector, Fundamentals of PAM, PAW & PPM.

Unit-II

Microwave Devices : Klystron, Reflex-Klystron, Principles of operation of Magnetrons, traveling wave tubes, Gunn diode.

Microwave Communication: Advantages and disadvantages of microwave transmission lines in free space, Propagation of microwaves , Atmospheric effects on propagation, Antennas used in microwave communication.

Unit-III

Radio and Television Receivers :TRF and super heterodyne receiver , block diagram of B & W T.V. , Transmitter and receiver.

Satellite Communication : Fundamental principle of satellite communication, Communication satellite link design, Satellite orbit inclination, basic elements of RADAR system.

Unit-VI

Optical Communication: Introduction to optical fiber, ray transmission step index, Grounded index , Single mode and multi mode , Fundamental of LED optical propagation theory, basic idea of optical detectors.

Reference Books:

1. Principle of Communication- Taub& Shelling
2. Communication System- S. Haykins
3. Communication System- Kennedy
4. Satellite Communication- D.C. Agrawal
5. Microwave Devices – Liao
6. Optical Fibre Communication- G. Keiser
7. Fibre optic communication & Practice- J M Senior

Practical-I

B011004P: Electronics Lab-IV

A. List of Experiments

1. Design and study of amplitude modulation and demodulation circuits
2. Design and study of pulse width modulation and demodulation circuits
3. Waveform analysis using storage CRO
4. Study of reflex klystron characteristics
5. Study of Gunn diode characteristics and PIN modulator

B. Industrial training / Field visit.

**Marks distribution :*

ETE : One practical – 50

CTE : Practical record (20) + Field visit (30) = 50

Practical-II

B011005P : Major Research Project/ Dissertation

Preamble

The concept of introducing the project will help the student community to learn and apply the principles of Physics and explore the new research avenues. In the course of the project the student will refer books, Journals or collect literature / data by the way of visiting research institutes/ industries. He/she may even do experimental /theoretical work in his/her college and submit a dissertation report with a minimum of 40 pages not exceeding 50 pages.

Format for Preparation of Dissertation

The sequence in which the dissertation should be arranged and bound should be as follows:

1. Cover Page and title Page
2. Declaration
3. Certificate
4. Abstract (not exceeding one page)
5. Acknowledgement (not exceeding one page)
6. Contents (12 Font size, Times new Roman with double line spacing)
7. List of Figures/ Exhibits/Charts
8. List of tables
9. Symbols and notations
10. Chapters
11. References